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Chelonastichus Ranjith & Quicke, gen. nov. (Hymenoptera, Eulophidae, Tetrastichinae) from Thailand: the first eulophid with a metasomal carapace

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Abstract

Chelonastichus Ranjith & Quicke, **gen. nov.,** is described based on a new species, *C. hanssoni* Ranjith & Quicke, **sp. nov.,** from Thailand. Whereas most Eulophidae exhibit a delicate, collapsible body, the new genus, is the first known case within the family that possesses a coarsely-sculptured metasomal carapace formed by Gt5, with Gt2–4 short. The possible affinities of the new genus are discussed and it is tentatively placed in the Tetrastichinae.

Keywords

New genus and species, oriental region, Southeast Asia, Tetrastichinae

Introduction

Here we describe a new genus of Eulophidae from Thailand which differs from all other members of the family in having a coarsely sculptured metasomal carapace formed by a much enlarged gastral tergite 5 (Gt5) with very short Gt2–4. The Eulophidae is one of the most hyperdiverse families of the superfamily

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Chalcidoidea, including 5300 species from 324 genera in five subfamilies (Bouček 1988; Rasplus et al. 2020; Burks et al. 2022; Butcher and Quicke 2023). Eulophids are one of the major components of parasitoid communities almost everywhere, and numerous species have been employed in biological control programs. Collectively, their known host spectrum covers more than 100 insect families (Yefremova et al. 2021). The subfamily Tetrastichinae includes 115 genera (UCD Community 2023). The subfamily is provisionally divided into two groups (Rasplus et al. 2020) as hypothesized by Graham (1987); 1) the *Aprostocetus* group of genera and 2) the *Tetrastichus* group of genera. Species of Tetrastichinae exhibit a wide variety of host associations including as spider egg predators and gall inducing mites (Butcher and Quicke 2023).

Most eulophids, particularly tetrastichines, have a very delicate body which can collapse when dried. Present study reports first case of carapace formation within the family Eulophidae. The metasoma of females is modified into a strong carapace similar to other parasitoid families in Hymenoptera, such as Braconidae and Ichneumonidae (Quicke 2015). Based on the presence of carapaced metasoma, we describe and illustrate a new genus, *Chelonastichus* Ranjith & Quicke, gen. nov., with the description of a new species, *C. hanssoni* Ranjith & Quicke, sp. nov., from Thailand.

Methods

The single specimen included in the study was collected with a Malaise trap from Sakaerat Environmental Research Station, Thailand. The specimen was dried using hexamethyldizilasane (HMDS) to avoid collapse of the body, and later card mounted. It was imaged using a Leica M205 C with Montage multifocus, interactive measurement and fusion optics stereo microscope, using the Leica Application Suite (LAS). The holotype of the new species is deposited in the Insect Museum, Chulalongkorn University Museum of Natural History, Bangkok, Thailand (CUMZ).

Morphological terminology follows LaSalle (1994) and, for cuticular sculpture we follow Harris (1979).

Morphological abbreviations used

CC = costal cell; **flg** = flagellum; **Gt1–7** = gastral tergites 1, 2, etc.; **HE** = eye height; **l** = length; mesoscutellum is used instead of scutellum; **msc** = mesoscutum; **MS** = malar space; **mss** = mesosoma; **ped** = pedicel; **ppd** = propodeum; **smg** = submedian grooves; **sct** = mesoscutellum; submedian grooves on mesoscutellum are used instead of submedian lines; **w** = width.

Results

Taxonomy

***Chelonastichus* Ranjith & Quicke, gen. nov.**
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Figs 1–3

Type species. *Chelonastichus hanssoni* Ranjith & Quicke, sp. nov.

Comparative diagnosis. The new genus *Chelonastichus* can be distinguished from all other eulophids by the autapomorphic character, Gt5 modified into a distinct carapace. The new genus is tentatively placed in the subfamily Tetrastichinae based on the following characters; axillae strongly angularly advanced, postmarginal vein of fore wing absent and submarginal vein of fore wing not smoothly continuous with parastigma. Most tetrastichines have submedian longitudinal grooves on mesoscutellum, but in *Chelonastichus*, gen. nov., these are almost indistinct. Apart from the metasomal carapace, the new genus distantly related to the following genera, *Aceratoneura* Girault from Australia and the widespread Old World genus *Sigmophora* Rondani based on the presence of transverse carina behind lateral ocelli (Bouček 1988). It differs from *Aceratoneura* by the number of funicular segments of the antennae and from *Sigmophora* by the number of anelli, and from both through the enlarged Gt5. In the key to European eulophid genera (Graham 1987) the new genus runs to *Nesolynx* Ashmead in having scattered setae on the middle lobe of the mesoscutum, mesoscutellum without submedian grooves and vertex with transverse ridge. In addition to its greatly enlarged and coarsely sculptured Gt5, *Chelonastichus*, gen. nov., differs from *Nesolynx* in not having a metallic tinge on head and mesosoma, antennal funiculars longer than wide, not distinctly transverse and mesoscutellum with an anterior row of strong setae.

Description. Female. *Head.* Antennae attached slightly below middle of frons, halfway between anterior ocellus and mouth margin; scape not reaching to upper level of vertex (Fig. 1B); pedicel stout (Figs 1E, 2E); antenna with two anelli and three funiculars, and three clavomeres with a weak constriction between C1 and C2 (Fig. 2E). Head with malar sulcus complete and straight (Figs 1E, 2E); without subocular fovea and genal carina (Figs 1E, 2E); clypeal margin convex without teeth (Fig. 1B, C); mandible bidentate, upper tooth wide, lower tooth acute (Fig. 1B, C); frons shiny, transversely striae anterolaterally associated with fine reticulations and with transverse carina medially (Fig. 1B, D); vertex finely reticulate with more or less complete transverse carina, rest of vertex unevenly sculptured (Fig. 1D); occipital margin rounded (Fig. 1D).

Mesosoma. Pronotum with long setae, distinctly reticulated and shiny, without transverse carina (Fig. 1D, F). Mesoscutum reticulated with a distinct median groove in anterior 2/3rd; with one pair of long and strong adnotaular setae posteriorly (Fig. 1F). Notauli complete without crenulations (Fig. 1F). Axillae advanced by half their length

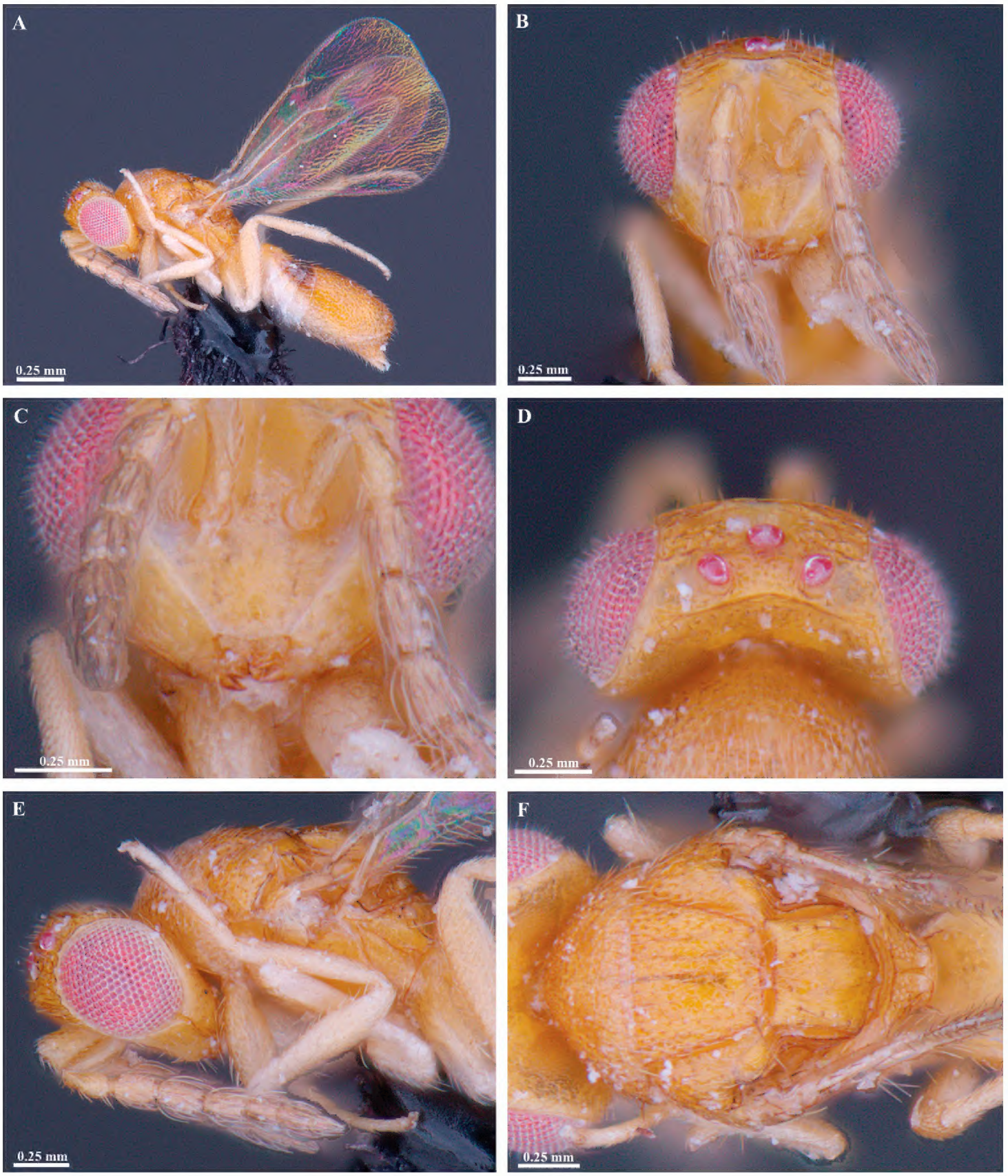

Figure 1. *Chelonastichus hanssoni*, gen. et sp. nov., holotype, female **A** habitus, lateral view **B** head, frontal view **C** face and clypeus, frontal view **D** head, dorsal view **E** head and mesosoma, lateral view **F** mesosoma, dorsal view.

in front of transscutal articulation (Fig. 1F). Mesoscutellum slightly convex in lateral view; with indistinct submedian grooves in posterior half; with sublateral grooves; with four pairs of setae sublaterally and a single pair of setae antero-medially; frenal groove present, wide and crenulated (Figs 1F, 2A). Dorsellum smooth and shiny, without median carina or groove (Fig. 2B). Propodeum with a wide and short fovea just behind dorsellum and a complete and strong narrow median carina that expands to a triangular

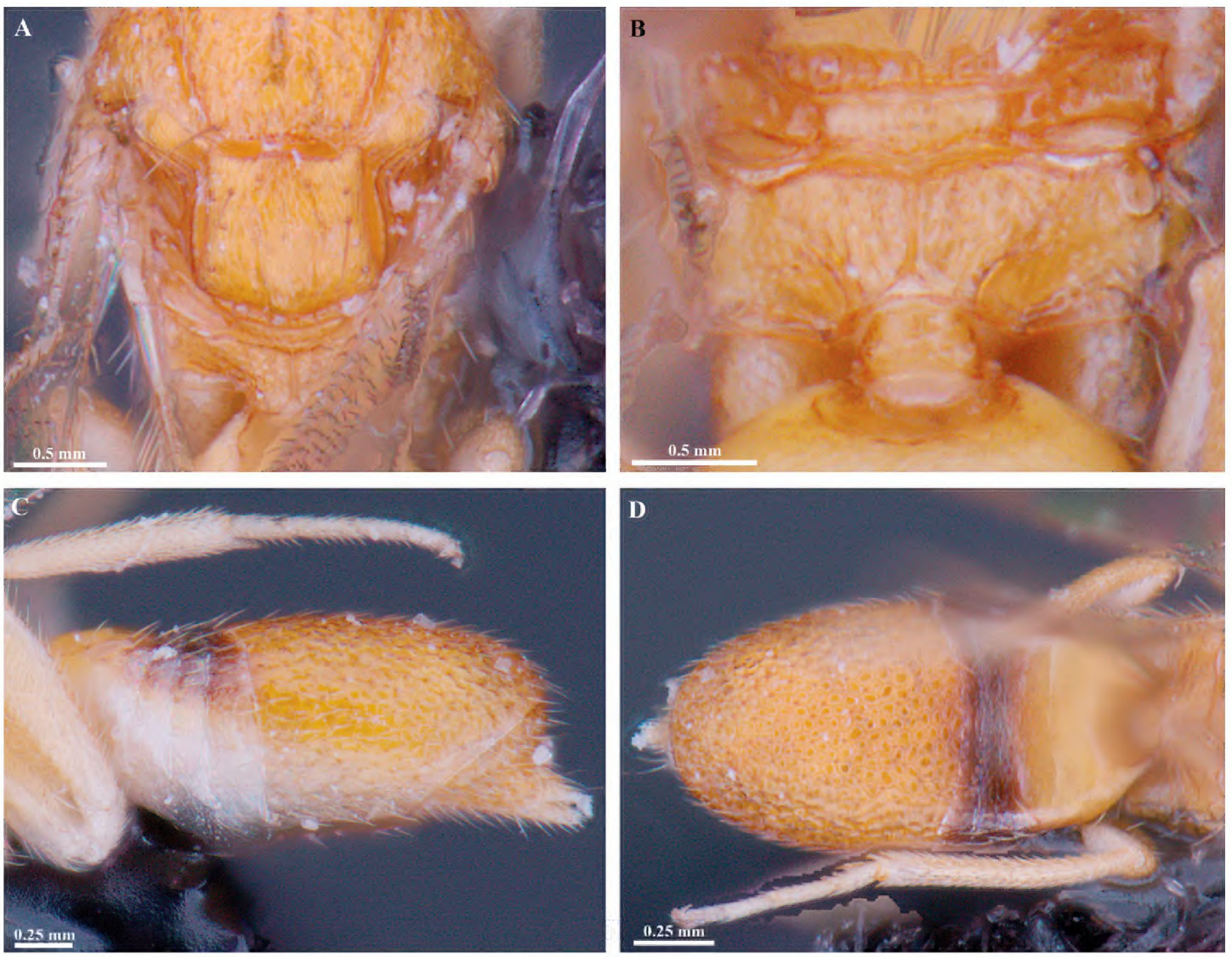

Figure 2. *Chelonastichus hanssoni*, gen. et sp. nov., holotype, female **A** mesoscutellum, dorsal view **B** propodeum, dorsal view **C** metasoma, lateral view **D** metasoma, dorsal view **E** antenna **F** wings.

shape posteriorly; without paraspiracular carinae; spiracles large, rounded and not covered by a flap; callus with three setae; plica distinct in apical half of propodeum (Fig. 2B). ***Wings***. Fore wing entirely hyaline (Fig. 2F); with four setae on the dorsal surface of a submarginal vein (Fig. 3D, E); postmarginal vein absent (Figs 2F, 3F); costal cell very narrow, 13.0× as long as wide (Figs 2F, 3D, E); speculum open (Figs 2F, 3D, E); stigmal vein with four companiform sensillae (Fig. 3F); posterior margin of hind wing with long setae (Fig. 3E). ***Legs***. Coxae with weak reticulation (Fig. 1A).

Metasoma. Petiole transverse, with irregular sculpture, smooth medially (Fig. 2B). Gaster 2.0× as long as wide, setose (Figs 1A, 2C, D, 3A–C). Gt1 smooth faintly reticulated, sparsely setose laterally (Fig. 2D); Gt2–4 faintly reticulated with transverse rows of setae (Fig. 2C, D); Gt5 modified into a carapace, strongly reticulate without interspaces, setose (Figs 1A, 2C, D, 3A–C); Gt6–7, strongly reticulate and retracted under Gt5 (Fig. 3A, B). Gt7 produced into a triangular process posteriorly (Fig. 3B). Ovipositor sheaths setose throughout (Fig. 3A–C). Female hypopygium reaching half the length of gaster, acute in lateral view (Fig. 3A, C).

Distribution. Oriental region (Thailand).

Hosts/biology. Unknown.

Etymology. The genus name derived from a combination of a generic name from the family Braconidae, '*Chelonus*' because of the first instance of carapace-like metasoma in the family Eulophidae and '*astichus*' from the subfamily name Tetrastichinae where this genus is provisionally included.

Chelonastichus hanssoni Ranjith & Quicke, sp. nov.

https://zoobank.org/2CEC224E-64D3-4DD3-8A86-30ED91C41B03

Figs 1–3

Description. Female, holotype. Length 2.6 mm.

Head. Eye setose (Figs 1A–E, 2E); F1 slightly shorter than F2 (Fig. 2E); face smooth and shiny (Figs 1B, C); malar space with sparse setae (Fig. 1E); scrobes shallowly impressed, smooth (Fig. 1B). ***Mesosoma***. Axillae finely reticulate (Fig. 1F). Mesoscutellum finely strigose associated with indistinct reticulations (Fig. 1F). Propodeum with weak reticulation throughout, with several anteriorly diverging carinae originating from posterior margin (Fig. 2B).

Ratios. Head: w/l (dorsal view) 2.9; w/l (frontal view) 1.3; POL/OOL 1.8; posterior ocellus w/POL 0.6; head w/mss w1.2; mouth w/MS 0.5; MS/HE 0.7; scape l/HE 0.7; distance toruli to anterior ocellus/toruli to mouth margin 1.4; flg+ped l/mss w 1.3; scape l/w4.3; F1 l/w 1.3; F2 l/w 1.8; F3 l/w 1.6; clava l/w 4.6; ped l/F1 l 1.3; F1 l/F2 l 0.9; F1 l/F3 l 0.9; F1 l/clava l 0.4; F2 l/clava l 0.4; F3 l/clava l 0.4; F1 w/ped w 1.1; antennal spicule l/C3 l 0.2. Mesosoma: l/h 1.5; l/w 1.9; midlobe msc l/sct l 1.1; dorsellum l/ppd l 0.5; sct l/w 0.9; CC l/w 13.0; CC l/MV l 0.65; MV l/SV l 5.0; metafemur l/w 4.5; metatibia l/w 6.5. Metasoma: petiole l/w 0.5; gaster l/w 2.0; gaster l/mss l 1.3; Gt1 l/w 0.6; Gt5 l/w 1.1.

Colour. Body yellow except eyes and ocelli reddish, antennal clava brownish orange, Gt2–4 brown.

Material examined. ***Holotype*** • ♀ Thailand, Nakhon Ratchasima, Wang Nam Khiao district, Udom Sap subdistrict, Sakaerat Environmental Research Station, dry evergreen forest, 14°50.911'N, 101°92.963'E, 402 m, 30.vi–12.vii.2021, Malaise trap, coll. K. Chansri (deposited in CUMZ).

Distribution. Thailand.

Etymology. The species is named after Dr Christer Hansson, Lund University, Sweden for his outstanding work on Eulophidae.

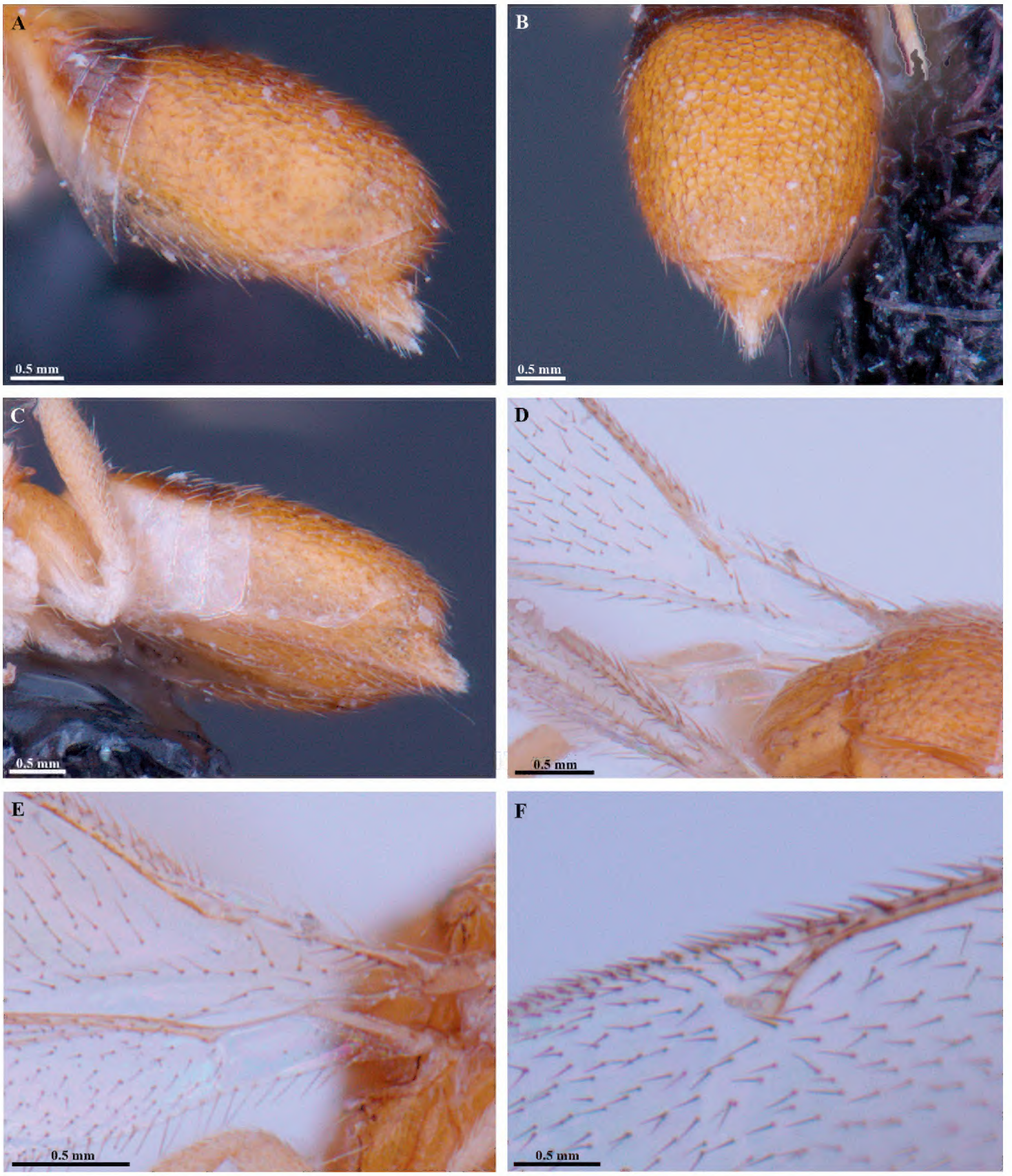

Figure 3. *Chelonastichus hanssoni*, gen. et sp. nov., holotype, female **A** apical tergites, lateral view **B** apical tergites, dorsal view **C** metasoma, ventro-lateral view **D** base of fore wing **E** base of fore and hind wing **F** fore wing stigmal vein.

Discussion

Heavily sculptured metasomal carapaces have evolved on numerous occasions in the Braconidae and on a far smaller number of times in the Ichneumonidae. Within the Chalcidoidea, a number of families have genera with one or more gastral tergites considerably enlarged, especially Gt1. Members of the Diapriidae, Eucharitidae, Moranilidae and Perilampidae typically have Gt2 enlarged so as largely to

conceal more posterior segments (Bouček 1988; Burks et al. 2022). But in none of these cases is the carapace heavily sculptured. In the family Leucospidae males have Gt2–5 or G3–5 fused to form a highly sclerotised, and sculptured carapace that largely conceals most of the remainder of the gastral tergites (Bouček 1988). As far as we can tell the new species represents the first example of a heavily sculptured carapace formed from Gt5 in the Chalcidoidea.

Based on some correlations of carapacisation with biology it appears that possessing a metasomal carapace is often associated with oviposition into something hard such as an insect egg or pupa, or a plant gall (van Achterberg 1988; Wharton 1993; Quicke 2015). Concordant with this, the distantly related genus *Sigmophora* has been reared from gall-forming Cecidomyiidae (Bouček 1988). Unfortunately, the biology of the new species is unknown.

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